Bintoniella brodiei Handlirsch (Orthoptera) from the Lower Lias of the English Channel, with a review of British bintoniellid fossils

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Synopsis

The Bintoniellidae is an extinct family of Mesozoic Orthoptera Ensifera. Fifty-three specimens of *Bintoniella brodiei* Handlirsch (mainly wings) from seven localities in southern England and the English Channel were examined. These specimens are from four different zones of marine Lower Lias and Rhaetian deposits (Lower Jurassic and Upper Triassic). It is concluded that *brodiei* is sexually dimorphic by analogy with recent bush-crickets (Tettigoniidae). The palaeoecology of the fossils is discussed.

Introduction

During the study of fossil insects from the British Jurassic a specimen was received from the Institute of Geological Sciences which had been found in a core of Lower Lias drilled under some 78–80 m of water (see p. 146) below the surface of the English Channel. This wing (Figs 1, 2) was clearly similar to some of the Orthoptera amongst the fossils already being studied. Because of the interest of the new locality, a more detailed study of these related Orthoptera was undertaken. They had not been included in Zeuner's monograph of the Orthoptera Ensifera (1939) because he regarded them as part of a 'side branch from the phylogenetic line' (Sharov 1968). Material from all the British Lower Jurassic in the collections of the Institute of Geological Sciences, British Museum (Natural History) (BM(NH)) and Bristol Museum has been examined, although no specimens of Bintoniellidae were found in the latter. Over fifty specimens were found, mostly wings but with some body structures, which probably represent the same species of *Bintoniella* and are conspecific with the specimen from the English Channel.

Systematics

Family **BINTONIELLIDAE** Handlirsch, 1939

The family Bintoniellidae was proposed by Handlirsch (1939) based on the drawing of an insect wing by Brodie in 1845 under the title of a 'Neuropterous insect allied to *Chauliodes*'. Brodie's figure was copied by Handlirsch who also proposed a new generic and specific name for the fossil. There is no evidence that Handlirsch examined the original specimen. Subsequently Sharov (1968) redefined the family and genus based on new material from the Lower Trias of the USSR and some specimens from the Lower Jurassic of Britain (incorrectly recorded by Sharov as Upper Trias). Sharov (1968) figured two specimens (In.10464, In.10583) which are both from the type locality of the species in Warwickshire and are also in the BM(NH) collection.

Genus ***BINTONIELLA*** Handlirsch, 1939

TYPE SPECIES. By monotypy, *Bintoniella brodiei* Handlirsch (1939 : 55).

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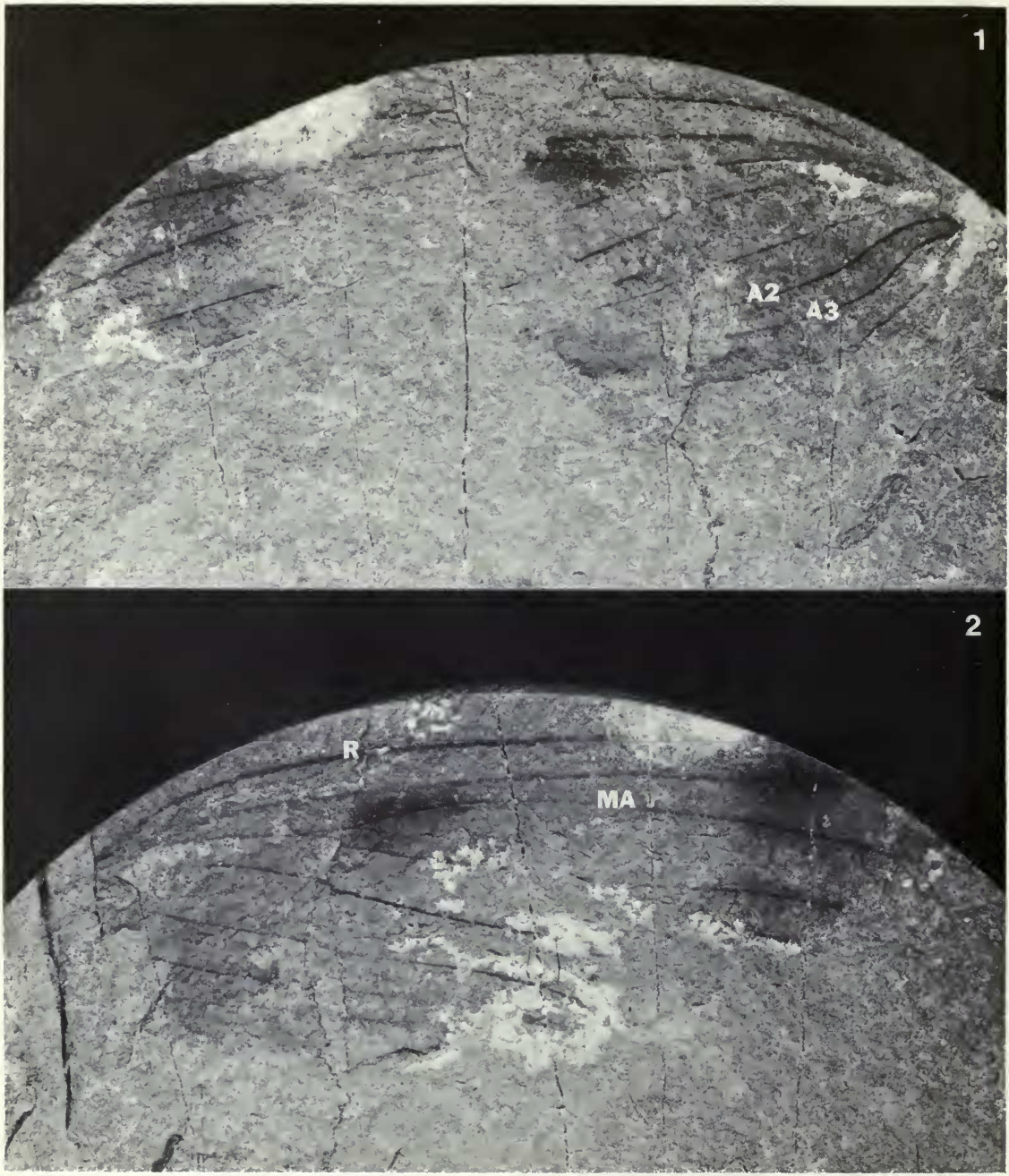


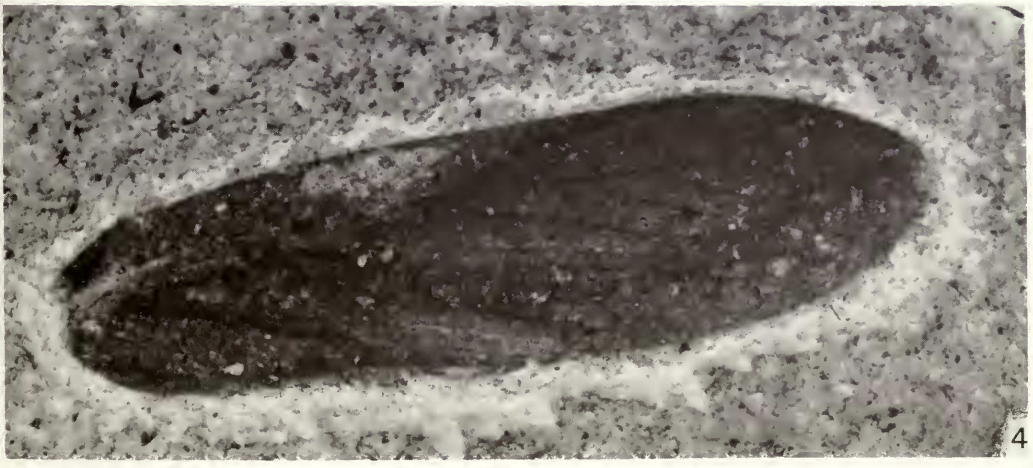
Figs 1, 2 *Bintoniella brodiei* Handlirsch. Fig. 1, male, forewing. English Channel, *c.* 67 km south of Plymouth. Lower Jurassic, Rotiforme Subzone of Bucklandi Zone, Lower Lias. Institute of Geological Sciences, C.S.E. 6178. Length 33 mm, width 11 mm. Fig. 2, the same (counterpart); C.S.E. 6179.

Handlirsch characterized the family and genus by the large precostal area at the base of the forewing (Fig. 6). Sharov (1968) also used this character and pointed out that the number of branches of MP and CuA in the British specimens is reduced; he considered CuA as a cross vein which joins MP near the base. While this is true of many specimens, in some CuA may separate off after fusing with MA for a short distance and run separately to the wing margin. Sharov related the Bintoniellidae to the Vitimiidae, both of which he placed in the Oedischiidea, a superfamily of the Orthoptera Ensifera.

Bintoniella brodiei Handlirsch, 1939
Figs 1–6

1845 'allied to *Chauliodes*'; Brodie : 102; pl. 10, fig. 6.
1939 *Bintoniella brodiei* Handlirsch : 55.
1968 *Bintoniella brodiei* Handlirsch; Sharov : 41, fig. 16.

HOLOTYPE. Male. Lower Lias, Binton, Warwickshire; *ex* Brodie coll. BM(NH) In.10463 (Fig. 3). This is one of the larger specimens from the Planorbis Zone at Binton. It has only a lightly sclerotized membrane which has not been preserved over most of the fossil.



Figs 3, 4 *Bintoniella brodiei* Handlirsch. Planorbis Zone, Lower Jurassic, Binton, Warwickshire. Fig. 3, holotype male, forewing. BM(NH) In.10463. Length 31 mm, width 12 mm. Fig. 4, female, forewing. BM(NH) In.6784. Length 27 mm, width 9·5 mm.

OTHER MATERIAL. All specimens except the last are in the BM(NH).

Binton, Warwickshire: Males, In.6652, In.6661, In.6675, In.6766, In.6783, In.10578, In.10932, In.11080. Females; In.3375, In.3383, In.6656 (Fig. 6), In.6770, In.6780, In.6784 (Fig. 4), In.10464 (Sharov 1968 : 41, fig. 16), In.10479, In.10585, In.10933, In.10935. Sex indet.; In.3384, In.6654, In.6659, In.6773, In.10463.

Brown's Wood, Warwickshire: Hind wing; In.10588. Female; In.10616. Male (?); In.10592.

Stratford-on-Avon, Warwickshire: Sex indet.; In.6799, In.10475, In.10668.

Grafton, Warwickshire: Females; In.6799, In.10495, In.11217.

Strensham, Worcestershire (Rhaetian, see Whalley, in press): Males; In.10439, In.10447, In.10457, In.10530, In.10538, In.10539, In.10542, In.11109, In.11112, In.11237. Females; In.10443, In.10554 (Fig. 5). Sex indet.; In.10446, In.10532.

Climbers (no other data, Warwickshire ?): Female; In.6790.

Lower Lias, England (no other data): Females; In.15002, In.15012.

Western English Channel *c.* 67 km south of Plymouth (78–80 m below sea level) at depth 17·72 m: Male part and counterpart; C.S.E. 6178+6179 (Figs 1, 2). This is from the Rotiforme Subzone of the Bucklandi Zone, Lower Lias. In the Institute of Geological Sciences.

All the specimens examined fall clearly into the two size groups mentioned below and are regarded as males and females of one species, *B. brodiei*.

DESCRIPTION. Where preserved, the precostal area is large (Fig. 6) and the subcostal vein reaches well towards the wing tip. There are strong, regular cross-veins between this and the radial vein. Rs separates in about the middle of the wing and forms four or sometimes five branches to the wing margin. The characteristic median vein is described below while Cu_1 is apparently fused with MP, separating in a few specimens at the wing margin. Of the three anal veins, A2 and A3 form a distinctive and highly characteristic loop at the base of the wing where they join. This shows clearly in many of the specimens examined.

DISCUSSION. Sharov (1968) illustrated the hind wing of this species, which shows the characteristic median branching of the forewing, lacks the precostal area and has a greatly enlarged anal fan. The forewing from the English Channel (Figs 1, 2) is incomplete but clearly shows the median vein branches and the anal loop. It evidently had a more curved outline and was one of the larger specimens here regarded as the males of *B. brodiei*.

Only the wing impressions of bintoniellids were available to Sharov and earlier workers but some parts of the body have now been found. This shows a typical 'bush-cricket' type of body-shape and a strongly spined hind tibia on which the spines are arranged in two rows. The tarsal segments were also lightly spined. The antennae have not been found but like other bush-crickets were almost certainly long and filamentous.

The large size and delicate venation of the precostal area (Fig. 6) shows well in many of the specimens examined: see Ragge (1955). The most characteristic feature is, however, the triple branching of the median veins. There is some variation in the number of divisions of the anterior radial vein which usually has four main branches but in some specimens a fifth branch is present. Apart from these small differences, the venation of the specimens is very constant.

DIMORPHISM. The most striking feature of the material examined is the two sizes of wings with similar venation but with differences in the degree of sclerotization of the wing membrane (compare Figs 1–3 with Figs 4–6). The complete wings of the larger specimens are 34–45 mm long × 10–12 mm wide. These specimens show very little trace of the wing membrane, which suggests that it was probably lightly sclerotized. The smaller wings are 25–30 mm × 7·8–9·2 mm and have the wing membrane in most cases clearly visible on the matrix as a black area, suggesting that, in life, these wings were more heavily sclerotized. The outline shapes of the wings differ, with the smaller, more sclerotized wings having more or less parallel costal and hind margins, while the larger ones have more curved margins. Although it is possible to consider them as two distinct species with similar venation, I think

Figs 5, 6 *Bintoniella brodiei* Handlirsch. Fig. 5, female, forewing. Rhaetic, Strensham, Worcestershire. BM(NH) In.10554. Length 26·5 mm, width 9·0 mm. Fig. 6, female, forewing, precostal area arrowed. Planorbis Zone, Lower Jurassic, Binton, Warwickshire. BM(NH) In.6656. Length 28·5 mm, width 9·0 mm.

that this dimorphism represents a sexual difference within one species. Ragge (1960) commented on sexual dimorphism in the Acrometopae (Orthoptera, Tettigoniidae) and particularly in the genus *Horatosphaga* Schaum., in which the males have large wings which are more lightly sclerotized than those of the females. The shape of the wings is also different, the males having a more curved margin while female wings are straighter and more slender (Fig. 7). Amongst the specimens of *B. brodiei* studied, there are twenty males and twenty females while twelve specimens are too incomplete to sex.

Distribution and habitat

Although insect fossils are common in Lower Jurassic deposits from Dorset, no specimens of Bintoniellidae have been found and it would appear that the family was not represented in the area from which they were derived. The Dorset fossils include many ammonites together with the insects (Zeuner 1962), which suggests a coastal derivation. A possible ecological

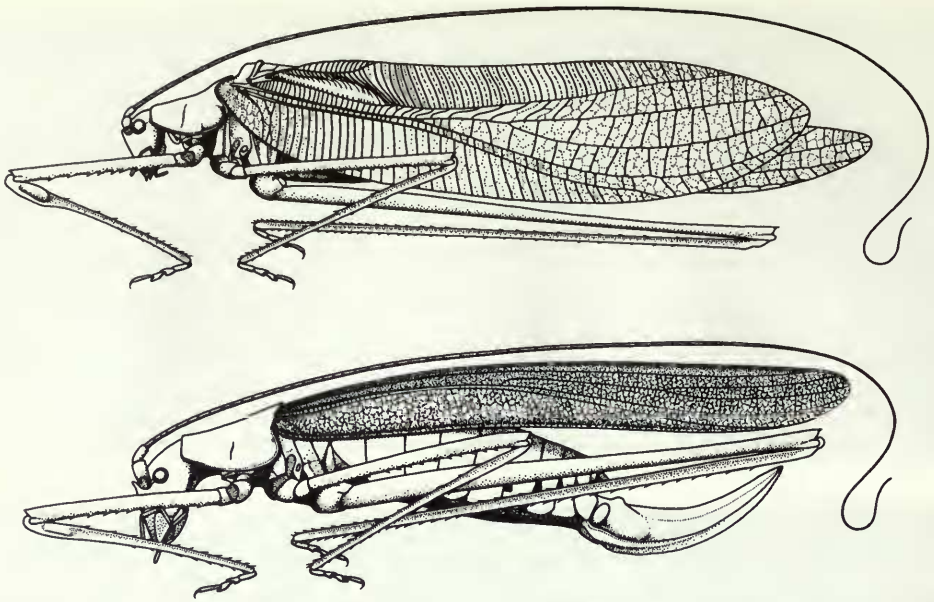


Fig. 7 *Horatosphaga* sp. (Orthoptera: Tettigoniidae). Recent bush-cricket, male above, female below, showing sexual dimorphism in shape and texture of forewing (Illustration from Ragge, 1960 : 275, fig. 1).

difference is thus indicated, as well as the stratigraphic differences which exist between Dorset and the Midlands. The Binton beds are Planorbis Zone and those of Strensham are Rhaetian, older than the Bucklandi Zone of the Channel, while the Obtusum Zone of Dorset is stratigraphically the youngest.

An interesting problem raised by the discovery of the specimen from the English Channel is its origin. Was it there because it flew out to sea and was trapped in marine mud, or was the core taken from close to the Jurassic shoreline? Generally the modern representatives of the long-horned bush-crickets are not long-distance migrants. Many are relatively solitary in their habits although some of the tropical species swarm at certain times of the year. If *B. brodiei* is dimorphic and broadly comparable in this respect to Recent *Horatosphaga* (see Ragge, 1960) then the females may even have had reduced hind wings and been unable to fly. Examination of the two specimens in which fore and hind wings are associated shows them both to be the larger (male) insect, which therefore was presumably able to fly. There is no direct evidence yet that female bintoniellids were unable to fly. The specimen from the Channel is also a large, male, specimen.

The bush-crickets are stout and substantial, and less prone to the effects of strong winds than many other insects. On balance, I consider the Channel specimen was either brought down in a river and deposited at the site where it was found, or that the species actually lived nearby. The latter would imply that during the Lower Jurassic the English Channel area, in or near where the fossil was found, was covered in trees and other vegetation and ecologically similar to the area where *Bintoniella* was abundant in the Jurassic, at Binton, Warwickshire.

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